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THE I.C.I. MAGAZINE

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The *I.C.I. Magazine* is published for the interest of all who work in I.C.I., and its contents are contributed largely by people in I.C.I. It is edited by Sir Richard Keane, Bt., and printed at The Kynoch Press, Birmingham, and is published every month by Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1. Phone: VICtoria 4444. The editor is glad to consider articles for publication, and payment will be made for those accepted.

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FRONT COVER: *Japanese Carnival Scene, by A. J. Maier (Head Office)*

OUR CONTRIBUTORS

Roy Bowyer *is head of I.C.I. Architectural Section. He joined the Company in 1937 at Winnington and came to Head Office on release from the Forces in 1946. He has designed buildings for the Company in many overseas territories as well as in this country, his most notable recent project being the Magadi Housing Scheme.*

Kenneth Everard *has been a personal assistant to Sir Alexander Fleck since 1957. He joined the Research Department of Plastics Division in 1951 after seven years at Oxford. In 1955 he was seconded to I.C.I.A.N.Z. for three months to assist in the production of a new grade of P.V.C. This year he accompanied the Chairman to the Far East.*

Morley Shier *retired from Canadian Industries Ltd. some four years ago and lives near Vancouver. For the greater part of his life he was concerned with the sale of explosives, which brought him into intimate contact with the Canadian mining industry.*

The New Look in Building

By Roy Bowyer (Head Office Architectural Section)

Many millions of pounds have been spent by I.C.I. since the war on new buildings. Consciously I.C.I. has tried to make these buildings attractive places to look at, attractive places to work in, and places more accurately suited to needs.

THE discovery that factories and offices can be made pleasant places to work in—and to look at—is quite a recent one. Until well into this century a factory was simply a box to contain machinery, and an office a box to contain people. For appearances' sake the box might be given what was considered to be an imposing façade, but behind this were drabness, darkness, cramped working space and lack of hygiene.

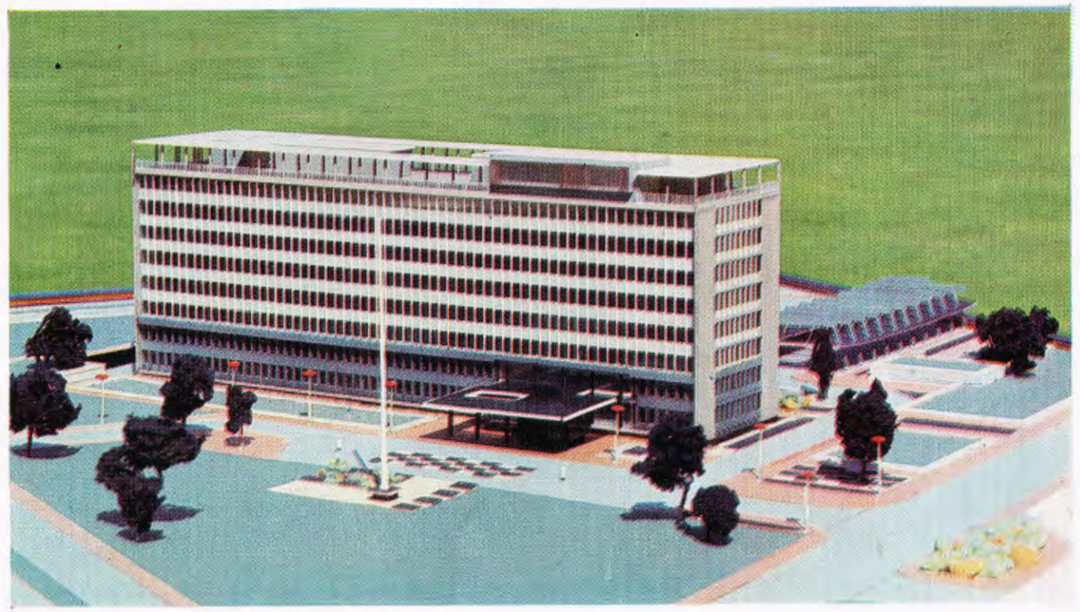
The results of this thinking can be seen all over industrial Britain (and indeed in most countries of the world): Victorian factories, with highly ornamented façades hiding the grimmest of interiors; Victorian offices, ponderous without and like rabbit hutches within; factories built before the first world war and still standing, unfortunately, in all the glory of their rusted iron sheeting—bad buildings, all of them, and bad places to work in. Between the wars the design of industrial buildings improved as far as their layout was concerned, but people could still not accept that the appearance of a factory, office or shop ought somehow to express its function. The result was a rash of devices that seem sadly tawdry today, such as neo-Egyptian façades for cigarette factories and Tudor get-ups for department stores.

There were honourable exceptions to this dismal catalogue. One of them was the laboratory block designed for the Blackley Works of Dyestuffs Division in 1936 by two German architects, Mendelsohn and Chermayeff. At the time it was admired as a radical departure from contemporary industrial design, and even today it retains an honesty and integrity that architects can learn from.

What about industrial architecture today? Not all of it is good, of course, and not all of it will last even as long as the Blackley laboratories. But the best of it is transparently more pleasing and more efficient than ever before. There are a lightness, brightness and dignity about that seem to express a revolution in thinking: the man in the factory is no longer an eight-hours-a-day prisoner, but a sensitive human being whose reaction to light, colour, warmth and space is greater happiness, greater enthusiasm and greater efficiency.

You may ask how this has come about. It is partly because business economics demand places that are attractive to work in and efficient to work in. Partly because land is scarce and expensive, so that a tauter approach to the whole problem of designing industrial buildings is called for. Partly because new materials and new techniques have come along to make the architect's job easier. And partly because much of the pretence has gone out of the business. A factory is a factory, an office is an office, and people are tired of the attempts to make them into Greek temples and Tudor manor houses.

I.C.I. can claim to have kept well to the fore of this new movement, through the medium of the Head Office Architectural Section, which holds a watching brief on I.C.I. building throughout the world and sometimes acts as architect as well. When you consider the amount of building undertaken by I.C.I. since the war you can see that this has been quite a big job. At home there have been many new projects carried out involving the design of office blocks, laboratories, glasshouses, canteens, farms, amenity buildings and houses. Abroad there have been, again, large new office blocks, plant buildings, warehouses,



A model of the new Billingham office block, *typical of the clean lines of present-day design*

Reception hall *at the Technical Services and Development Department of Paints Division at Slough. Note the spacious setting with diffused lighting and fluted walls, which today takes the place of the old-fashioned enquiry office. A visitor thus has an attractive first impression.* BELOW: **The Colour Advisory Section office** *of Paints Division, an example of well-planned accommodation. Daylight is an all-important factor for colour work, and this office has been designed to give it to the full.* RIGHT: **An unusual stairway** *at the Alderley Park Research laboratories of Pharmaceuticals Division. At no extra cost this stairway, made of aluminium, concrete and glass, provides an attractive architectural feature that catches the eye and breaks the rigid lines of the building.*

New office block *at Plastics Division headquarters designed for flexible accommodation. Internal partition walls can be reassembled quickly to alter the size of a room. The panels between the windows are of plastic. Bricks and mortar are used only for end walls. Most of the building materials in this type of block are prefabricated, ensuring shorter construction time.* BELOW: **Rocksavage Works Canteen,** *General Chemicals Division. Note generous window space, veranda and surrounding garden.*

and even a complete new township for 4000 people at Lake Magadi. With all these new buildings, whether acting as architects ourselves or briefing independent architects, we have had two thoughts in mind before all others: will this building do what is required of it, and will it look right? Not until questions such as these are answered satisfactorily does the building go up.

Our job begins when a Division or overseas I.C.I. company decides to consider a new building. Existing buildings have become so overcrowded, perhaps, that it becomes essential to enlarge them or build new ones. A small committee is set up to review the requirements and to report to the I.C.I. Board that a new building is necessary to house additional office or factory workers, and will cost in the order of *x* thousand pounds. When the Board has given its sanction an architect is appointed—either an architect in Head Office or in one of the Divisions, or an architect in private practice. With the committee he considers possible locations for the building, the time factor, the type of layout, type of structure, internal finishes, standard of lighting, the flexibility required, and last but not least whether extension is likely to be needed in a few years' time.

Urea formaldehyde plant *operated by Plastics Division at Wilton. The pleasant appearance of this plant contrasts with nineteenth-century and even pre-war factory design.*

Once he has his brief the architect makes sketch drawings and a model. From these he prepares the final drawings for approval by a design committee, and meanwhile consults with the structural engineers on the design of the steelwork or reinforced concrete, and with the heating, ventilating, electrical, acoustic and lift engineers about the various services of the building. And finally, specifications and bills of quantities must be drawn up and put out to tender.

Let us see, from a recent example, how this works out in practice. New offices were needed to house the 500 staff working in huts and buildings scattered throughout the Metals Division headquarters site at Witton, Birmingham. Head Office Architectural Section were appointed architects, and found that the first problem was one of space. Space on the Witton site was very limited—there was obviously no room for a sprawling two- or three-storey block. Therefore it must be a tall building. How tall? At this stage an

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People and events . . .

I.C.I. in U.S. Synthetic Fibre Project

I.C.I. is planning to invade the American man-made fibres market. A simultaneous announcement on both sides of the Atlantic at the end of September gave the news that the Company is joining forces with the Celanese Corporation of America to set up a new company in the States for the purpose of manufacturing a polyester fibre chemically the same as 'Terylene' which will be sold there under the trade name 'Teron.' I.C.I. is contributing the know-how and the Celanese Corporation, a pioneer in the production and marketing of man-made fibres in the U.S.A., the marketing network. As we go to press, the location of the plant to manufacture the polyester fibre has not yet been announced, but capacity of the new plant is expected eventually to be 40,000,000 lb. a year.

A further announcement last month named the British members of the new company's board. They are **Mr. E. A. Bingen** (I.C.I. Overseas Director), **Dr. A. Caress** (chairman of Fibres Division), and **Dr. E. D. Kamm** and **Mr. C. I. Rutherford** (Fibres Division Directors). The president is Mr. J. H. Black of the Celanese Corporation.

To start with, the new company was known as the Lindum Corporation.

* * *

Why Lindum? Dr. Kamm provided the answer for us. Choosing a name for a new company is not as easy as it sounds, apparently. Every name put forward seemed already to have been used by someone else. Time was getting short. Then the secretary of the Celanese Corporation had the idea of looking at an old map for a pleasant-sounding name. He mentioned that he was born in Britain at Lincoln, which was called Lindum by the Romans, and suggested something on those lines. Everyone liked Lindum, so the search for a map was called off and the Lindum Corporation it became.

But this only lasted a fortnight. On 16th October the new company was renamed Fiber Industries Inc.

The signatories of the I.C.I./Celanese Corporation agreement: Mr. John W. Brooks (Celanese vice-president), Mr. Harold Blancke (Celanese president), Mr. P. C. Allen and Dr. E. D. Kamm

Costs Up, Profits Down

THE Company's half-yearly accounts and the interim dividend of 2⅔%—the same as a year ago, allowing for the one-for-two scrip issue—received wide comment in the press. This is what they had to say:

The Times. Imperial Chemical Industries' setback in profits in the first half of 1958 is an unpleasant reminder of the reduction in profit margins which industry has had to face this year. I.C.I. states without reservation that the drop in group profits before tax, to £24,401,000 from £30,244,000, in the first half of 1957 is due principally to the operation of some plants at lower outputs and to increases in costs such as wages, and fuel and transport charges, without corresponding increase in selling prices. Sales were virtually unchanged on the half-year at £232m. against £235m., but they showed an increase of £4m. compared with the second half of last year.

Manchester Guardian. The half-yearly figures of Imperial Chemical Industries will disappoint the optimists. But they are satisfactory in the light of trading conditions in the industry.

Daily Sketch. The City had a shock yesterday from Sir Alexander Fleck, chairman of Imperial Chemicals, Britain's biggest company. For he told shareholders of a sharp drop in profits in the first half of this year—from £14,917,000 to £12,429,000. "Trading conditions for the first half of 1958 were more difficult than in recent years," he said. But I.C.I. has really done well in the circumstances—because sales at £232,000,000 were only £3,000,000 lower. Costs went up, but selling prices were kept down. Shareholders get an interim dividend of 2⅔%—the same as a year ago, allowing for the larger capital.

The day after the announcement I.C.I. share prices fell just over a shilling to 33s. 4½d. But within a week they were back to 34s. 4½d.

Cocoa Bug Doomed

THE capsid bug is responsible for the loss in Ghana alone of 60,000–80,000 tons of cocoa a year, or the equivalent of one year's production in every five. In hard cash this represents something like £15m. a year at current prices. That is why the Ghana Government is next year embarking on a giant spraying campaign—during the first three years of operation they intend to spray 2½ million acres of cocoa.

Plant Protection's 'Gammalin' 20 is the insecticide chosen, and an agreement with the Government of Ghana for the supply of the whole of their requirements over the next three years was signed last June. It will be made at a plant to be erected at Tema, a new deep water port just east of Accra. Construction is due to begin almost any day now, and the factory is scheduled to be in operation by July 1959. It will be the first factory in West Africa to produce agricultural chemicals and is, too, I.C.I.'s first West African factory. All the labour in the factory will be Ghanian. This represents only a fraction of the labour force to be employed by the Ghana Government, who in carrying out their spraying operations will require over 400 spraying gangs totalling nearly 14,000 people.

* * *

The capsid bug feeds on the leaves and new shoots of the cocoa tree. Its saliva is poisonous, and a single puncture is enough to kill off a new shoot. In badly infested areas the complete tree canopy is reduced to leafless poles. Swollen shoot disease, which threatened to annihilate the cocoa-growing industry in Ghana and Nigeria, received so much attention in the immediate post-war years that these crop losses from capsids tended to be overlooked. All this was changed, however, with the 1953 Cocoa Conference held in London under the auspices of British cocoa and chocolate manufacturers. An outcome of this was the collaboration between Plant Protection and the Ghana Government, which has led in less than five years to a practical solution of the capsid problem.

The P.P.L. research teams out in Ghana were led by **Mr. J. H. Stapley,** the senior entomologist at Fernhurst, and **Mr. I. J. Balls,** head of the machinery department.

Exploring in Labrador

IF you had just spent seven weeks in the wilds of Labrador, tramping through about a thousand miles of thick forest, living off the land in extremes of climate from 100 degrees in the shade to 10 degrees below zero, would you call yourself lucky? Two apprentices at the Billingham factory recently had this experience, and they certainly do. They are **Richard Hirst,** an apprentice electrical fitter at Ammonia Works, and **Trevor Millington,** an apprentice fitter in the main Billingham workshops. They were among a party of 60 who went with the Schools Exploring Society to Labrador. The society was founded in 1934 by Surgeon-Commander G. Murray Levick, who was with Scott on his last expedition to the Antarctic.

Landing at Goose Bay, the party under army leaders made its way inland and set up a base camp on the shores of a lake. Here it split into five groups. Richard was attached to a group which did survey work, and Trevor was with one whose duties included supplying the other with food and equipment. There was plenty of excitement. On one occasion a black bear got mixed up with the party, on another a sudden gale whipped up fifteen-foot waves on a lake where Trevor was piloting a small boat.

Travelling on another waterway, the shear pin of the propeller broke four times, and everyone had to jump out and hold the boat against the force of the river while a new pin was put in. Had they lost the boat, they would have been stranded in uninhabited country without supplies.

Transformation Scene

"WHEN is a canteen not a canteen?" The answer, proved by photographic evidence, is "When it is transformed into a gracious banqueting hall."

When the Institute of Metals, seeking a room in Birmingham large enough for its golden jubilee banquet, asked Metals Division for the use of its largest canteen, there were many who thought the choice a little strange. A works canteen, however admirable for its purpose, does not offer quite the same standard of comfort and elegance as a five-star hotel.

Doubts were unfounded. The 700 guests who attended the banquet on 25th September (headed by the Institute's president, Marshal of the Royal Air Force Lord Tedder, and the Lord Mayor of Birmingham) had nothing but praise for their agreeable surroundings and for the superb quality of their six-course dinner.

The brunt of the work involved in the transformation fell on employees of Kynoch Works Management and Division Catering Department. Thanks to very detailed forward planning, dislocation of normal arrangements was kept to a minimum and Oscott Hall was closed to its usual customers for only one day.

Jet-propelled News

LITTLE if any of the enormous newspaper publicity given to the Comet 4 mentions one item of particular interest to I.C.I. readers—the fact that Metals Division is supplying De Havilland with products of critical importance to the safe and successful operation of this phenomenal aircraft.

It was largely because the aircraft industry urgently needed a new structural metal that I.C.I. devoted such a big effort to developing titanium, which would enable aircraft designers

NEWS IN BRIEF

Atomic Lamps. New exit signs in the Cockcroft Hall at the Atomic Energy Research Establishment, Harwell, are illuminated by continuously burning atomic lamps. The signs are made of 'Perspex.'

I.C.I.A.N.Z. in World War II. The latest volume of the Australian Official War History entitled "The Role of Science and Industry," by Professor D. P. Mellor, gives considerable prominence to the part played by I.C.I.A.N.Z. in World War II. I.C.I.A.N.Z. and I.C.I. receive 33 separate indexed references, and the work of at least twelve I.C.I. or I.C.I.A.N.Z. people is mentioned by name.

More about the Colour Film Link-up. Further details announced of the proposed colour film link-up between I.C.I. and Ilford include the appointment to the Ilford Board of Mr. L. H. Williams, I.C.I. director in charge of the Dyestuffs and Pharmaceuticals Divisions, and Dr. J. Avery, Dyestuffs Division chairman.

Champion Firemen. A Trimpell fire-fighting team from Heysham won first prize in the heavy trailer pump drill at the national finals in London of the annual fire-fighting contest organised by the National Fire Protection Association. 72 teams took part in the finals, including two from Billingham and one from Dowlais Factory.

Equatorial Sash. I.C.I.A.N.Z. mathematicians have estimated that the amount of 'Visqueen' film sold in Australia over the last three years is enough to tie the earth with a three-foot wide sash right round the Equator.

New I.C.I. Newsletter. The first issue of *Caribbean Courier*, a four-page newsletter for I.C.I.'s agents and customers in the West Indies, appeared last month. It is to be published three times a year.

Work Study and the Farmer. On 5th October the whole of the B.B.C. television programme "Farming" was based on the work and experience of the C.A.C. Agricultural Work Study Unit. Gordon Lugg, head of the unit, used film, charts and models to illustrate improvements made to pig-keeping and dairying practice on two farms in the Midlands and the Pennines; and Peter Smith, one of the farmers concerned, spoke enthusiastically of the results which work study had achieved for him.

Water for Wilton. At the turn of a screw key on 5th September by Wilton Technical Director Mr. J. Hughes, the first trickle of water lapped over the weir to start the process of filling Wilton's new 10 million gallon reservoir at Lazenby.

Twenty-four to One. Mr. H. Golombek, three times British chess champion and chess correspondent of the *Observer*, took on twenty-four of Tees-side's top chess players—sixteen of them from Wilton and Billingham—in an exhibition of simultaneous chess playing staged at Wilton on 1st November.

7000 at Billingham Sports Field Ceremony. The official opening of the new Billingham sports field by the Earl of Derby, treasurer of the National Playing Fields Association, was watched by almost 7000 Synthonia Club members and visitors. As a souvenir Lord Derby was presented with a discus made by I.C.I. craftsmen from two I.C.I. materials, 'Perspex' and titanium.

I.C.I. Chemists in Canada. At the end of September a party of twenty young chemists drawn from ten I.C.I. Divisions and Wilton Works flew to Canada to take part in the annual meeting of the Society of Chemical Industry, held this year in Montreal. The current president of the society is Mr. H. Greville Smith (president of C.I.L.). From Montreal the I.C.I. party went on to the States, where they visited the I.C.I. (New York) office and various U.S. chemical firms.

Plant Protection Changes. Cooper, McDougall & Robertson Ltd. have sold their remaining holding in Plant Protection Ltd. to I.C.I. Plant Protection, formed jointly by I.C.I. and Cooper McDougall in 1937, is now a wholly owned subsidiary of I.C.I.

to save still more weight without any loss of strength. In three years I.C.I. titanium has found its way into virtually all the military aircraft now being produced and most of the civil airliners.

In the Comet 4, titanium is used not only for components in the Rolls-Royce Avon engines but for several major structural assemblies. These include engine skinning, bulkheads, engine seal rings, rear air intake ducts, engine cowl doors and firewalls.

Marston Excelsior Ltd., an I.C.I. subsidiary attached to Metals Division, has been specialising for many years in products for the aircraft industry, and employees at Fordhouses are proud to know that Marston heat exchangers and flexible fuel tanks are helping the Comet 4 to break still more records for Britain.

Millionaires

To be a millionaire for a day, if only on paper, must be quite a novel experience. But that is how **Mr. R. E. White** (Billingham Division Labour Department) and his fellow passengers on a holiday cruise to Europe's northern capitals found themselves headlined in a Polish newspaper when they landed at the Polish port of Gdynia. The party of 140 British, American and French visitors were the first foreign holidaymakers to go to Poland since the war, and they were

described in a front-page story in the newspaper as industrialists and businessmen travelling in "a luxury ship for a very expensive cruise." Millionaires or not, when the boat docked at Gdynia the passengers found that the quay was decked out with English, American, Norwegian and French flags and that there was a large crowd to welcome them.

Burns Honour

The honour of being president of the Burns Federation in 1959 has fallen to **Mr. A. N. Campbell,** Scotland and Northern Ireland Region commercial services manager.

Mr. Campbell

His election was announced at the federation's annual conference held at Harrogate in September. His term as president covers the bicentenary celebrations of the birth of Robert Burns. The federation comprises some 350 affiliated clubs and kindred societies throughout the world.

Mr. Campbell himself is a member of the Glasgow and District Burns Association, and for close on thirty years he has been honorary treasurer of the Jean Armour Burns Houses at Mauchline, which are managed by that association and where ten elderly women live rent and rates free and receive a small pension. As part of next year's celebrations the Glasgow Association also plans to complete twenty new houses on the historic farm of Mossgiel, near Mauchline, and it is hoped that the official opening will take place during Mr. Campbell's term of office.

Mr. Campbell has been in the selling organisation in Scotland for 42 years, and at various times has held the position of secretary of Arthur and Hinshaw Ltd. (selling agents for Brunner-Mond), area sales manager, regional sales manager and, at present, regional services manager.

Safety Prize Shared

The judges for this year's essay competition organised by Safety Department failed to separate the two top entries. So **Mr. J. Heap,** a foreman at Dyestuffs Division's Blackley Works, and **Mr. H. Bradbury,** an assistant process foreman at Alkali Division's Wallerscote Works, were declared joint winners and are now each the richer by £15. The third prize went to another Alkali Division man, **Mr. V. Booth** of Avenue Works. **Mr. W. Hand** (Dyestuffs Division) and **Mr. W. Jameson** (General Chemicals Division) received consolation prizes.

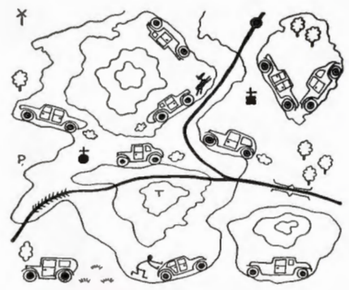
The subject set for the essay competition was "human failing" accidents —the sort of accident caused by falls, lack of concentration, sheer foolhardiness, or as often as not just by being in too much of a hurry. Last year, out of a total of 981 lost time accidents in the Company, this type of accident accounted for no fewer than 494.

Looking back on the records, we noticed that last year's safety essay prizewinner was **Mr. W. Heap**, a shift foreman at the Hillhouse factory of Plastics Division. Mr. W. Heap and Mr. J. Heap are not related, but perhaps there is something lucky in the name.

Monte Kynoch Rally

A second "Monte Kynoch Rally" for amateur car rally enthusiasts in the Metals Division was held on 28th September. Twenty-four cars left the centre of Birmingham at 11.30 a.m. and (in most cases) finished in the early evening at a country inn at Romsley after 75 miles of intimate exploration of Ordnance Survey maps 130 and 131.

The programme, meticulously designed by **Mr. Fred Freund** to test driving, navigation and ingenuity to the utmost, consisted of three sections;



in each map references and control points had to be found by intensive map reading, detective work and the solving of abstruse clues. True to his promise, he had so stiffened up the course that only six cars passed through the first secret control point!

The weather, although not at its best, did not mar the success of the rally and perhaps lent additional relish to the steak sandwiches prepared at a barbecue to greet the returning ralliers. Winners were **Mrs. M. Richards** in a Ford Anglia, **Mr. K. Boodson** in a Morris Minor, and **Mr. H. D. Marquis** in an Austin A35.

Afterthoughts on the Expo

On 19th October the Brussels International Exhibition closed its gates for the last time. Back in London after his six months' stint as manager of the I.C.I. stand, **Mr. Bill Marrable** recalls some of the highlights. Of the distinguished visitors to our stand the Duke of Edinburgh, of course, took first place. His visit was made on 10th July, the first of the British national days, and he was conducted round the stand by Sir Walter Worboys (Commercial Director), who immediately following the departure of the royal visitor had to dash quickly to the exhibit of the Council of Industrial Design at the far end of the building where, as chairman of that Council, he had again to receive the Duke. Others whose names appear in the visitors' book include Princess Margaret (see page 389), Mr. Heathcoat Amory, the Lord Mayor of London, Sir Denis Truscott, the Earl and Countess Mountbatten of Burma, Mr. Hugh Gaitskell, Mr. Aneurin Bevan and Mr. Donald Campbell.

Russians, always in parties and never individually, visited the stand in large numbers during the first two months. They were, recalls Mr. Marrable, voracious lifters of literature and took handfuls of 'Terylene' staple fibre from the large bowl of this material on the stand. 'Terylene' and polythene were the products of greatest interest to the Russian parties, of whom Mr. Mikoyan, first Deputy Prime Minister, was on one occasion a member.

Practically any exhibition job can be described as nine-tenths frustration, and it says a lot for Bill Marrable that he still finds amusing the true story of one lady visitor to the I.C.I. stand who was very interested in 'Terylene.' She inspected the 'Terylene' blouse and skirt being worn by the receptionist and showed so much interest generally that the receptionist took her round and explained the dyestuffs, pharmaceuticals, paints and other displays. At the end of it the visitor said: "Now isn't that wonderful! And to think that all this comes from 'Terylene'!"

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Many hundreds of I.C.I. employees must have visited the Expo during the past six months. The largest invasion of the lot came early last month, when a party of 130 from Paints Division, Head Office and Southern Region chartered two Hermes aircraft and flew to Brussels for the week-end. The trip was organised by **Mrs. D. Hailey** of the Slough Recreation Club.

The Billingham Petrol Story

Billingham has made its last petrol. Last month, exactly 23 years after Mr. Ramsay MacDonald, who was then

Prime Minister, opened at Billingham the first plant in the world to produce petrol on a commercial scale from coal, some 200 employees who worked on the plant in the early days and their wives were entertained at Billingham to mark the closing down of the petrol process. In those 23 years 750 million gallons were made.

But Billingham's interest in the "coal-oil" process goes back long before 1935. Several busy years spent on laboratory and semi-technical work resulted in the starting up of an experimental 10-ton plant in 1931. Its success enabled the Company to convince the government of the day that home-made petrol from British coal and creosote could be made on a commercial scale. Cost was the major drawback. It was far too expensive to compete with imported petrol. With the passing of the Oil Bill giving a tax rebate on home-produced petrol the position changed, and in 1933 the I.C.I. Board voted £3m. for a full-scale oil plant. In 1935, when it was formally opened by Mr. MacDonald, it was producing 230 tons a day.

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The demands of war gave Billingham's petrol plant—and the sister plant the Company built for the Government at Heysham—a new importance. Output switched to high-grade aviation fuel, and by 1940 Oil Works was producing *iso*-octane to add as a blending agent and to make the petrol more potent still. But the battle of the buzz-bomb is the highlight of Billingham's petrol story. When the pilotless planes were first launched against the south of England in the summer of 1944 there was no real defence against them. Some were brought down by anti-aircraft guns, but they were too fast for our fighters. Then Oil Works produced 'Victane,' a new blending agent which gave Billingham's petrol sufficient extra quality to put a few miles an hour on the fighter's speed. From then on more and more were shot down before they reached thickly populated areas.

After the war there were many changes. From aviation fuel Oil Works turned to pool petrol, and then back again to aviation fuel for the Berlin airlift. And finally to premium motor spirit. But over the years it had become obvious that Oil Works' future lay in the by-products rather than the petrol. The gradual running down of the petrol-producing process and the conversion of the plant to other uses, based mainly on raw materials from the oil crackers at Wilton, is the background to the "split" nearly a year ago from which emerged the new Heavy Organic Chemicals Division. (*See the petrol story in pictures on pp.* 392–93.)

PEOPLE

Sir Alexander Fleck has been appointed chairman of the Minister of Power's Scientific Advisory Council. The council was set up in 1948 to advise the Minister on the scientific aspects of his statutory duties.

Two C.I.L. staff, **Mrs. Catherine Hughes** and **Mr. Stan Waters,** were members of the Montreal Bach Choir which sang at the Brussels World Fair and at the Edinburgh Festival.

Over 700 people paid to see Prudhoe Factory's leek show held on 20th September. The first prize went to **Mr. David Ruddick** for a pair of leeks measuring over 80 cu. in.

A Botany factory process worker, **Mr. Tom McCormack,** has been awarded £80 under the I.C.I.A.N.Z. Suggestion Scheme. This is the fourteenth major prize of £50 or over since the new scheme began just over two years ago.

Mr. Bill Hamilton (Nobel Division) was a member of the Royal Scottish Country Dance Society team which was invited to take part in Munich's eighth centenary celebrations in September. Earlier this year he had the honour of dancing before the Queen and the Duke of Edinburgh at Holvrood House.

The I.C.I.A.N.Z. Technical Director, **Mr. L. W. Weickhardt,** has been installed as general president of the Royal Australian Chemical Institute, one of the highest honours which can be held by an Australian chemical scientist.

An explosives van driver at Ardeer Factory, **Mr. John Hershaw,** has won Ardeer Recreation Club's three single-hand bowling prizes this year—the first ever to win this bowls "triple."

Welcome to London

WITH the riots at Nottingham and in Notting Hill so recently in the news we feel that readers may be interested to learn of the work of the Overseas Friendship Club, which was started up in Kensington last spring and which owes its existence to a very considerable extent to a member of Head Office Overseas Department, **Mr. K. D. Moss,** who is the club's chairman. Its aim is to introduce overseas students to Londoners and to give them an opportunity of experiencing the genuine friendship for which the British are remembered by those who really get to know them. The organisers believe that if these students return home with happy memories of British hospitality there will be less of the bitterness that is now apparent in places like Colombo and Singapore.

To welcome these students and other overseas visitors, monthly parties are held. Over two hundred students come every month—students from Nigeria, the West Indies, India, Malaya, Fiji—in fact from some seventy different countries to date. During the summer there was also a garden fête and a river trip up the Thames.

But what every student longs for more than anything else, say the organisers, is the chance to visit a British home and to see how a British family lives, so the next job of the club is to find families who would be happy to entertain overseas students, particularly those living in Central London or outside London but within "week-ending" distance. If you would like to help in this, please write direct to Mr. Moss.

Quote of the Month

"THE ordinary people have grown bored with theories. They are interested in science, technology, and achievement generally."—*The Prime Minister at Wolverhampton on 30th September.*

Plus ça change . . .

"THE position in China continues to be a menace to the peace of the world, for there is always the danger of other nations being drawn into conflict with one another over China." This quote might have been culled from one of our national newspapers or weeklies only yesterday or from the week's "Sayings" in one of our Sunday papers. It might, but it wasn't. It is in fact the introductory sentence to an article on China which appeared in the very first issue of the *I.C.I. Magazine* in January 1928.

NEW APPOINTMENTS

Some recent appointments in I.C.I. are: **Dyestuffs Division:** Mr. T. B. Clark (Visiting Director). **Fibres Division:** Mr. C. I. Rutherford (Director). **Heavy Organic Chemicals Division:** Mr. N. J. Freeman (Visiting Director). **I.C.I. (South Africa):** Mr. J. T. M. Hughes (Managing Director). **Plastics Division:** Mr. A. F. Gawler (Commercial Services Director), Mr. D. J. Thompson (Deputy Chief Accountant).

THE NEW LOOK IN BUILDING (*continued from page* 367)

investigation was needed to see how much working space the 500 staff would need, how much circulating space, how much amenity space.

Nothing less than a ten-storey block would fill the bill, and even then it was essential to make economical and efficient use of every inch of floor area. Here the Office Administration experts were called in to help, and a unit design for offices was arrived at, to be repeated throughout the building with minor variations obtained by the use of movable walls.

An incautious architect might have rushed the building up on this basis, only to find that a trifling miscalculation had made nonsense of all his theories. Architectural Section chose to play it safe, and erected at Witton the office equivalent of a pilot plant: a full-scale office unit in which a complete mock-up of all types of office rooms envisaged were tried out—offices for the boss, offices for his personal staff, and offices for more numerous clerical staff. These offices were built with the actual windows, lighting and ceilings planned for the new building. They were all designed to a scale of square feet per employee (graduated according to status or job) which followed recommendations laid down by Office Administration Department. In this unit—built for economy in a timber frame—staff carried out their ordinary work for several weeks to test the efficiency of the layout and components. In the event everything proved satisfactory and no modifications were needed.

There were still all sorts of things to be taken into account. One fact that came to light was that the sheer weight of paper, filing cabinets and office machinery in a modern office means that the floors have to be very much stronger than of old. Again, the whole plan might have fallen to the ground if successful means could not be found of emptying this very tall building promptly at the end of office hours. From consultations with lift engineers we found that three automatic 500-feet-a-minute lifts would be needed.

By no means as an afterthought we had to consider appearance. Bricks and bricklayers being expensive and in short supply, curtain walling is the accepted answer for an office of this size, but we decided on brick facings for the end walls, and one of the innumerable small problems that had to be solved was where to get 150,000 uniformly burnt bricks in one consignment (they eventually came from Holland, in one bargeload).

The eventual result of all this was an office block of which, I think, we can be proud—a good place to look at, a good place to work in.

Compare this with another of our assignments—a very different one: the rehousing scheme for the Magadi Soda Co. at Lake Magadi in Kenya, which was entirely designed by H.O. Architectural Section. A complete new township was needed, with houses, flats, schools, churches, shops, swimming pools and clubs for four thousand people. The job was complicated by the fact that three different races live and work at Magadi: Europeans, Africans and Asians, each with their own social and religious customs. We not only had to design Anglican and Roman Catholic churches, but guide the design of a mosque and a Sikh temple as well. Each race required a different kind of living quarters, even different cooking arrangements. What we had to do, in fact, was to build three self-contained communities in the very limited space of this small oasis in the parched Rift Valley.

The last stages of this scheme are now going through. Already the members of each race are living in their new quarters, and Lake Magadi has become something of a showplace in East Africa. The flats for Africans, with running water, electricity and up-to-date cooking arrangements, are ahead of their time, and more than one company has done us the compliment of imitating them.

With plant building we are not, of course, so closely concerned. The design of plant buildings is very largely governed by the process that goes on inside them, but none the less there are many things we can do to make sure that the buildings are pleasant and comfortable to work in and reasonably attractive to look at. Lighting, heating, colour schemes and flooring materials all play a part in this. If possible the design includes gardens round the building. The result is cleanness and brightness that twenty years ago would have been regarded as impossibly Utopian for a factory.

With laboratories the design centres round the supply of services: water, compressed air, gas, electricity and vacuum lines. These must be brought to every bench in the building as inconspicuously as possible and yet remain easily accessible for servicing. In some laboratories, as in the animal breeding unit of the new Pharmaceuticals Division laboratories at Alderley Park, there may be very special requirements, such as a pure air supply. All these factors affect the design of the building. This functional approach, reflected in new buildings throughout I.C.I., has produced something much more attractive than the Victorians ever achieved with camouflage and window dressing.

Lastly, what about cost? It is no good pretending that cladding with non-traditional materials like glass and plastic sheeting is not more expensive than bricks and mortar. On the other hand, cladding offers certain pretty decisive advantages. First, most people find this type of building brighter and more attractive. Secondly, it has been quicker to construct; and time saved often means money earned. Thirdly, in some parts of the country contractors have been just unable to offer reasonable schedules for large buildings of bricks and mortar owing to shortage of bricklayers and their limited output per man. But what started, broadly speaking, as a post-war expediency to overcome shortages and bottlenecks has now become part and parcel of modern design and an accepted success.

Modern Marvels—10

THE ULTRA-VIOLET SPECTROPHOTOMETER

By L. A. Duncanson (Heavy Organic Chemicals Division)

Colour—or rather the invisible range of "colour" to which our eyes are not sensitive and which therefore we cannot see—provides the chemist with another valuable tool of analysis. By checking up with the spectrophotometer which wavelengths a substance under analysis will absorb, the chemist can know what that substance consists of and thus has a quick means of identification.

Illustration by H. J. Eric Smith

In our daily life we tend to take for granted the colours of objects around us, and it is probably rare for many of us to ask ourselves why different objects are differently coloured. However, such a question has often given, and still gives, the chemist much food for thought and leads him, in a literal sense, outside the field of normal perception.

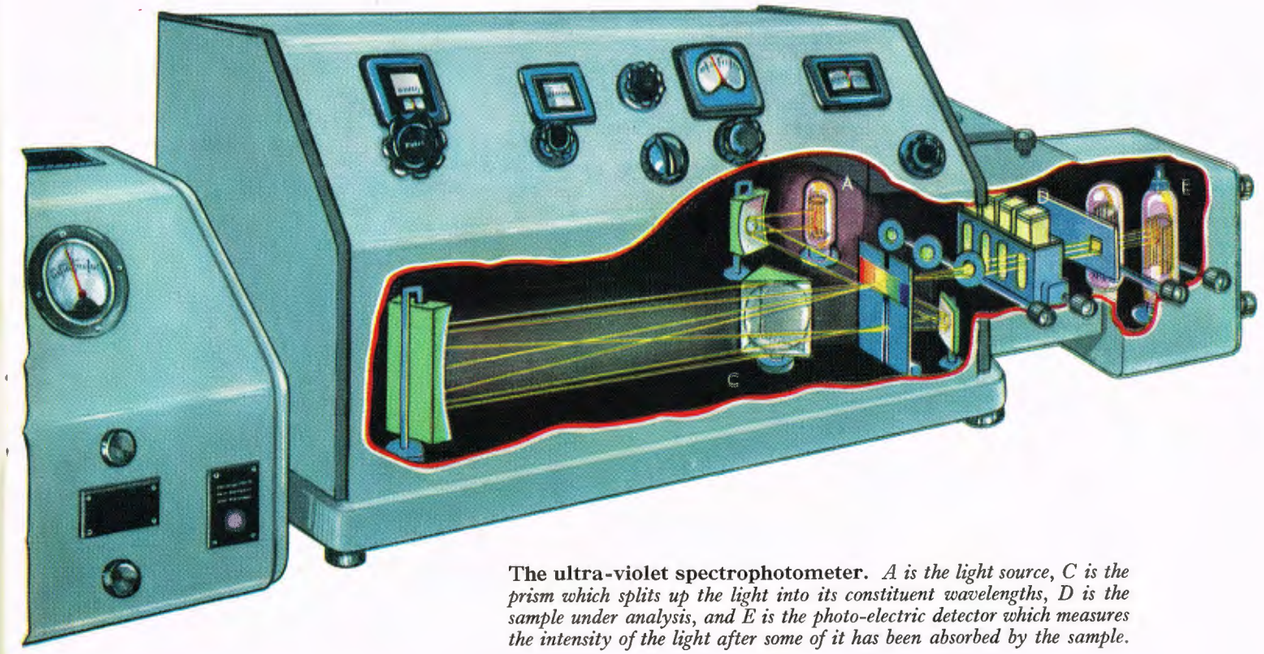
In this and the next article I shall describe briefly the way in which chemists make use of certain colour measurements to aid them in their work. We shall see that our visual concept of colour is a very narrow one due to the limitations of our eyes, and in fact what might be called "invisible colours" are more widely useful to the chemist than are the colours visible by eye. However, both visible and invisible colours have similar origins forming parts of a unified story, so we can begin with the more familiar scene before turning our attention to the unseen.

The beginning of the story goes back to 1666, when Sir Isaac Newton demonstrated that a ray of white light is made up from numbers of rays of different colours. By passing a beam of white light through a glass prism he obtained a colour spectrum and showed that this was caused by the blue rays being bent through a larger angle than the red rays. Previously it had been thought that the colours were produced inside the prism and not that they were originally present in the white light falling upon the prism.

Later work, culminating in Young's experiments of 1801, demonstrated the wave-like nature of light rays and, to cut a long story short, it became apparent that different colours of light correspond to waves of different wavelengths. Thus red light is composed of longer waves than blue light, and yellow light has a wavelength between these two.

When light falls on an object some of it is absorbed, and if some wavelengths are absorbed more than others the object appears coloured. For example, if the object absorbs the blue and red rays from white light, only the yellow rays remain to reach the eye and the object appears yellow. On the other hand, if the yellow rays are absorbed, leaving the blue and red to fall in the eye, the object appears mauve. This partially answers the question of why different objects have different colours but poses the more fundamental question: why do different substances absorb different wavelengths of light? This question cannot be fully answered in an article of this nature, but a partial basis for an answer is as follows.

The electrons which hold atoms together in molecules are not rigidly fixed in position but can vibrate within the molecule. The speed or frequency of vibration depends on how tightly they are held in the molecule, the tightly held ones having higher frequencies of vibration than the loosely held ones. Light waves passing through matter tend to set the electrons into vibration, and if some of the light waves have the same frequency of undulation as the electrons, energy is transferred from these waves to the electrons. Hence as the frequency of oscillation of a light wave is inversely proportional to its wavelength, measurement of the wavelengths absorbed by a substance gives information about the tightness with which electrons are held in the constituent molecules. This is important information concerning the chemical structures of molecules.



The ultra-violet spectrophotometer. *A is the light source, C is the prism which splits up the light into its constituent wavelengths, D is the sample under analysis, and E is the photo-electric detector which measures the intensity of the light after some of it has been absorbed by the sample.*

The materials such as dyestuffs, which absorb colours visible to the human eye, are only a fraction of the number of chemicals with which chemists in general have to deal. Most molecules have more tightly held electrons than those which cause visible colour, and consequently they absorb radiation of shorter wavelengths than occur in visible light. To measure the invisible colours of these materials recourse is made to the use of instruments called spectrophotometers. One of these instruments is illustrated in the picture, and its basic components are as follows.

1. First a light source (A), which emits a wide range of wavelengths, is necessary. A hydrogen arc lamp or a tungsten filament lamp is usually used.
2. A prism (C) to split up the light into its constituent wavelengths. To produce ultra-violet spectra a quartz or fused silica prism has to be used, because glass is not transparent to these shorter waves.
3. A photo-electric radiation detector (E) to measure light intensity at different wavelengths in the spectrum.

To investigate the light absorption of a substance with such an instrument a sample (D) is placed in front of the detector and the light intensity falling on the detector is measured at different wavelengths. In modern instruments different wavelengths are caused to fall on the detector by rotating the prism. The light intensities from the source at these wavelengths are measured both before and after the sample is placed in the instrument. In this way the absorption of light of certain wavelengths is observed as a diminution of light intensity when the sample is present.

A further development of these instruments has been brought about by the application of automation to them. They then become automatically recording spectrophotometers in which the radiation intensities falling on and transmitted by the sample are continuously measured as the radiation wavelength is changed. The ratio of these intensities is continuously recorded on a moving chart.

Instruments such as these make observations both in the visible and invisible parts of the spectrum. These observations tell the chemist a great deal about the molecular structures of materials such as antibiotics and dyestuffs, among many others. Moreover, the spectrophotometer not only measures the wavelength of absorbed radiation (i.e. the shade of colour) but also accurately measures the intensity or amount of absorption (i.e. the depth of colour).

Now, the intensity of absorption by a given chemical is related to the amount of that chemical in front of the detector. If this relationship is previously known it is often possible to estimate the amount of the chemical present in a sample of unknown constitution without the need for normal chemical analyses. Hence we have in the spectrophotometer yet another ingenious device for analysing quickly a chemical mixture and an opportunity for checking up that a product is uniform and that variations do not pass undetected.

Carnival in Japan

By Kenneth Everard

Photographs by the author

Last spring Nara in Japan—about the same population as Oxford—went all out on a carnival spree. And the occasion? The sixtieth anniversary of the elevation of the town to the rank of city.

To the visitor like myself, there just for a few days, perhaps the dominant impression of Japan is that the landscape looks like one vast market garden with plastic cloches dotted all over the place. Because of the acute shortage of arable land in Japan, which is predominantly a mountainous country, there is a strong incentive to make the utmost use of every bit of soil that will support crops. As a result, double the number of people are fed from each acre as in Britain, and the fertilizer usage per acre is the highest in the world.

The need for such intensive cultivation arises from the fact that Japan is not only overpopulated (90 million people live in an area little larger than the British Isles), but faces the problem of feeding an additional 1,200,000 mouths every year. At present 80% of the population can be supported on home-grown food, and it is only by exporting the products of its industries and by subsisting on relatively cheap food that Japan has conquered the poverty which so strikes the visitor to other Eastern countries.

So far from seeming destitute, the Japanese appear well dressed; and the quite incredible number of cameras that one sees suggest, at least to the superficial observer, a prosperity similar to our own.

A word of explanation about geishas may remove some romantic misconceptions. The best ones, at least in Japanese eyes, seem to be those with the most highly developed social accomplishments (such as conversation, singing and dancing). Since these are the fruits of long experience, it follows that the best and most expensive geishas are often on the wrong side of 40; this, of course, is in accordance with the best industrial practice, in which chargehands are generally old hands at the game and not the new recruits!

Flower arrangement is an art in which the Japanese are highly skilled; they are also keen gardeners. The simplicity of their gardens contrasts with the sometimes crowded appearance of a small, well-kept English garden. It is the same with the blossom. Living in Welwyn Garden City, I am used to avenues of thick blossom such as flourish in springtime a few hundred yards from the Plastics Division headquarters, where the trees are planted like lamp posts a certain distance apart. In Japan, however, though some trees thinly line city streets, most of them spread colour haphazardly, and they seem all the more beautiful and natural for that.

It was in a part of Nara where delicate pink blossom and the fresh green leaves of weeping willows were reflected in the placid water of the Sarusawa Lake that Sir Alexander Fleck, Alan Maier and I, together with Mr. Dickson and Mr. Fukutomi of I.C.I. (Japan), watched the carnival procession which celebrated the sixtieth anniversary of the elevation of Nara to the rank of city.

Nara, which claims the largest wooden building containing the biggest bronze Buddha in the world, is normally a sleepy city; but on that day it was very much alive. Every local inhabitant, and many others besides, seemed to be out of doors in the spring sunshine. Children were everywhere.

As I jostled through the crowds I would often see a pair of wide brown eyes peering at me from a toddler's cosy nest slung from its mother's back; or I would suppress a smile at the slightly older ones of

A huge Buddha, *the centre-piece of the procession. The Buddha was borne shoulder high by a dozen men, who drifted from side to side of the road swaying with emotion as in religious ecstasy.*

LEFT: **Two children** *dressed as fairies headed the procession, riding on a float covered with tulips and cherry blossom. The second fairy can just be seen through the fine gossamer wings of the fairy in the foreground.*
RIGHT: **Following the Buddha** *came Japanese youths wearing the traditional summer kimono worn in Japan before the country became westernised. The figure in the centre has a false nose and moustache.*

A ceremonial drum, *slung on a large pole, is taken very seriously by the onlookers*

both sexes, whose straight hair showed every sign of having been cut with the aid of a pudding basin and who mostly wore dark woollen stockings gartered well above the knee; or, again, I would wonder why it is that all the schoolchildren and students wore sombre black uniforms and black caps, as though the subfusc dress of the Oxford examination schools had once been admired and adapted for Japanese youth. The lugubrious clothes of these young bystanders were in harsh contrast to the colour and gaiety of the procession.

As the sound of music and drums drew nearer, every neck craned forward. First, a float, brightly decked with tulips and sprigs of cherry blossom, brought two young "fairies" dressed in voluminous yellow skirts and fine gossamer wings. Then came a grotesquely masked and bearded man who hobbled past on a stick followed by a retinue of laughing young boys dressed in peacock-blue kimonos. Then a ceremonial drum, slung from a wooden pole, was carried slowly past by two young men.

The centre-piece of the whole procession was a huge Buddha, borne shoulder high by a dozen men who drifted from side to side along the road, swaying with emotion as in religious ecstasy. No sooner had this passed than ripples of laughter welcomed the inevitable comedians, one with a false nose and black moustache, another dressed like Charlie Chaplin and riding in a rickshaw pulled by a fat clown. Then a demure little girl, full of grace and crowned with flowers, was carried by in an open sedan chair. She was followed by the May Queen (save that it was April) —petite, wasp-waisted, carrying a beautifully arranged bouquet of spring flowers.

Children who had tired of watching the long procession found that, not far away, goldfish dealers had spread their wares beside the road in shallow tanks lined with polythene film. For a few yen (farthings) the children were given a net consisting of rice paper stretched on a round wire frame with a wooden handle. The more skilful ones were able to catch some half-dozen fish with this flimsy equipment before the paper disintegrated in the water. These they carried home in polythene bags with the look of pride worn by successful fishermen all over the world.

ABOVE: **Perennial Charlie Chaplin,** *beloved of the whole world, draws a ripple of smiles.* NEAR RIGHT: **Two youths** *in summer kimono costume.* FAR RIGHT: **Roadside vendors of goldfish.** *For a few yen children fish for these goldfish with scoops made of rice paper. The game is to try to catch as many fish as you can before the rice paper disintegrates in the water.*

A TALE OF TWO PICTURES

By D. W. Gillings

D. W. Gillings is an economist working at the Central Instrument Laboratories. In this tale of two pictures he sees in miniature the whole story of human industrial endeavour.

Photos by courtesy of Holman Bros. Ltd., Camborne, and New Broken Hill Consolidated Ltd.

THIS is the story of two small pictures. I brought the first of these pictures with me when I left the mining and coking industry to join I.C.I. at the Central Instrument Laboratory. It is a picture about as typical as could be of the mining world, and was the view actually selected by Holman Brothers, the celebrated Cornish engineering company, as frontispiece for their centenary commemoration book *Cornish Engineers*. It is a print from an oil painting of the abandoned fire whim at East Pool Mine in moonlight.

"Fire whim" is the old Cornish mining term for a steam winding engine. East Pool is the name of the mine, a property located between Camborne and Redruth. The subject, the setting and the associations seem to imbue the picture with something of every aspect of mining and mines.

There are actually scores of engine houses like this around Camborne and Redruth. They stand on what is still claimed to be the richest square mile of metal-bearing land anywhere—yet all but one are abandoned today.

A contrast in mining gear. LEFT: *An oil painting of the abandoned steam winding gear of a Cornish tin mine. The first workings of this mine were in the early* 1800s, *and the mine finally closed down in* 1947. RIGHT: *The ultra-modern surface gear of the* 3000 *ft. deep lead/zinc mine in Australia, operated by New Broken Hill Consolidated Ltd.*

They stand as reminders of good times and of hard—tall, gaunt, narrow stone engine houses, now empty of the great beam engines perpetually pumping as well as winding from the shafts, with the stubby stone and brick topped chimneys which will never smoke again.

A tale in a few words would never do justice to the great history of the Cornish mining industry and the generations of miners of past days. The history of East Pool itself, with its long life and changing fortunes, is more than just a chapter in the story.

The mine was active—that is, was kept unwatered and open, though not continuously worked—since the early 1800s up to 1947. It saw and survived the heyday of English metal mining, the '60s to '80s of the last century, when there were over 200 active shafts—some down to 2000 ft. (and one or two much deeper at the end of those days), and when 60,000 miners were at work.

Two small pictures

Today, one mine near Camborne and one out at the cliff edge at Land's End remain, and only a few hundred miners. Even as late as the years before the 1939–45 war, great but unsuccessful efforts were made to work a rich remaining ore body at East Pool. But under today's conditions it was found impossible to raise new capital to keep the mine working.

The fire whim does not hang on my office wall simply from nostalgia for past active days. It is there to strike the contrast between the wealth that once lay ready and easy to mine and the fact that it has gone for ever. It hung on its own for some time, awaiting something to heighten the contrast. At first I thought that one of the great opencast ironstone mining draglines should be the other subject, but finally it was another mining picture that had the second hanging.

The second picture is of one of the most modern sinkings in the world. It is a colour photo of the new surface gear at the 3000 ft. deep shafts recently completed at New Broken Hill Consolidated, one of the newest ventures at the famous Broken Hill district of New South Wales.

New Broken Hill Consolidated is mainly a lead/zinc mine, producing concentrates for smelting a few hundred miles away at the coast, at Port Pirie. This sort of large-scale operation is typical of what has to be done today to get mineral wealth from ever more remote regions, in contrast to the intensive, small-scale and inherently rewarding workings in Cornwall well under a century ago. But whereas Cornwall and other English districts were yielding most of the country's needs of the commoner metals in those days at no cost in the trading account, the imports that we have to make today cost something which has in the last resort to be paid for by manufacture.

Why these pictures? Partly because they have some merit as pictures. But also because they convey something of the point I have just touched on—that today there is a constant challenge to renew old sources of wealth as well as find more wealth for the growth of industry. It wants little imagination to read the story of human industrial endeavour in the events of the life of a Cornish tin mine.

In the early days there were the old mining men with little more resources than their own strength and skill, driving thousands of yards of tunnels, sometimes at depths of a thousand feet or more, much in granite, and with only sledge hammers to drive their drills, or steels as they called them. All this, and the added hazards of blackpowder—earliest and perhaps most dangerous of all explosives used for blasting—and of the all-pervading dust. Sometimes the most ambitious hopes of quick wealth were realised, but many were the hopes that were dashed as once-rich ore bodies were worked out. Now this is almost over, and the great Cornish mining community is dispersed, many overseas in new prospectings.

Sort of large scale

All that has happened in Cornish mining so clearly and so evidently, has happened in industry elsewhere in Britain. Just as easily won mineral wealth has gone, so capital equipment in many older industries has been finally worn out and old transport facilities once described as the finest in the world are now badly in need of adapting to modern needs. While the sombre finality of the worked-out mine is rarely met in full in industry, there is ever the need to renew and extend, to make fresh wealth when old wealth has gone, to replace from abroad the rich native minerals which once met our needs and to keep costs within bounds.

ZIRCONIUM—THE WHY AND WHEREFORE

By A. Carter (Metals Division)

I.C.I.'s manufacture of yet another "new" metal—zirconium—was announced this summer. The reasons that make this metal a "must" for certain types of atomic reactors, together with the special difficulties encountered in its extraction and purification, are here explained.

ZIRCONIUM is not "new" in the sense that it is a recent discovery—it was identified as a metal nearly 150 years ago. But it proved extremely difficult to extract pure metal from the ore (the silicate zircon) and even more difficult to convert it into useful massive forms. Moreover, though it was realised that it might have certain inherently useful properties, these did not at the time appear sufficiently outstanding to justify a costly research and development effort.

With the advent of nuclear engineering, and the consequent demand for materials with specific and unusual combinations of properties, the search for new structural metals gained a fresh impetus. Many metals hitherto regarded as curiosities have been re-evaluated to ascertain whether they meet the exacting needs of nuclear engineering and whether, in the light of recent metallurgical advances, they can now be produced at anything like an economic cost. Of the metals re-examined in this way the most promising are beryllium, niobium, vanadium and zirconium; and of these, zirconium should no longer be considered as a rare or new metal, but as a commercial metal with certain very specialised applications.

Zirconium is a silvery-grey metal with physical and chemical properties similar to those of titanium. Its density, however, is about one and a half times greater, so that it does not have the same very attractive strength/weight ratio. As with titanium, the strength of zirconium varies with purity—pure metal is the softest form available, while the presence of even traces of non-metallic impurities, such as oxygen and nitrogen, results in hardening. At room temperature pure zirconium will withstand a pull of 22–28 tons per square inch before fracture.

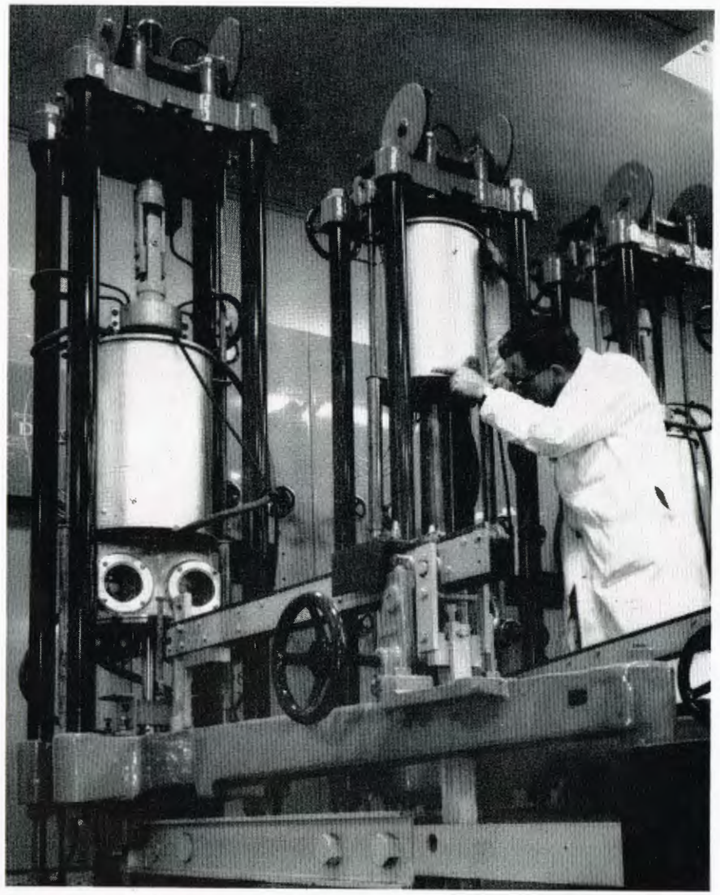
Zirconium is an attractive nuclear engineering material because it is one of the very few metals which, when used in a nuclear reactor, absorbs comparatively few neutrons, has good mechanical strength at moderate temperatures, and is compatible with uranium fuel up to a high temperature. Zirconium alloys have been developed which are particularly valuable for use in water-moderated and water-cooled reactors, because their corrosion resistance to high-temperature pressurised water and steam is superior to that of most reactor metals. The choice of alloying constituents is limited by neutron absorption and other nuclear considerations, and the alloys so far developed are not so very much stronger than unalloyed zirconium.

The silicate zircon, which is found in beach sands, is widely distributed throughout the world. Raw zirconium in sponge form is extracted from these sands by chemical processes generally similar to those used to extract titanium. There is, however, an added complication. A sister metal, hafnium, occurs naturally to the extent of 1–2% in all zircon deposits; because hafnium readily absorbs neutrons, it must be separated from the low neutron absorber zirconium during the extraction process. (Incidentally, advantage is taken of the high neutron absorption characteristics of hafnium, which is used for control rods in pressurised water reactors.)

Because the reactivity of the metal, particularly in its molten state, precludes the use of conventional furnaces and refractory-lined crucibles, raw zirconium sponge is consolidated into ingot form by the consumable electrode vacuum arc melting process developed for titanium. In the Metals Division zirconium melting plant production of commercially pure and reactor grade zirconium and zirconium alloys is now on a full commercial scale; ingots weighing half a ton are regularly produced, and if required, ingots weighing as much as 3 tons can be melted in one of the new Heraeus furnaces in the Division's titanium melting plant.

Ingots are converted into wrought forms—strip, sheet, plate, rod, tube and wire—by conventional processes, though precautions must be taken to avoid contamination during hot working and annealing, particularly by nitrogen, which impairs corrosion resistance. For thin sections vacuum annealing methods are preferred. Metals Division (and the I.C.I. subsidiaries Marston Excelsior and Amal, which form part of it) also supplies certain finished components in zirconium.

The main outlet for zirconium and its alloys is for fuel sheathing and other structural components in nuclear reactors of the pressurised water type. Because of their compactness, pressurised water reactors are particularly suitable for marine propulsion, and they have already been installed and successfully operated in several U.S. submarines —including the *Nautilus* and *Skate* —as well as in the Shippingport power station. All these reactors incorporate considerable quantities of Zircaloy 2 (zirconium alloyed with tin, iron, chromium and nickel). The pressurised water reactor to be installed in the British Admiralty's first atomic submarine, *Dreadnought*, will also incorporate substantial quantities of zirconium alloy.



Creep testing of zirconium *in progress at I.C.I.'s Creep Test Station at Witton, Birmingham. These machines measure the effect of prolonged small strains applied to metals and have resulted in a better understanding of the problem of fatigue.*

In this country most of our nuclear power effort has been devoted to developing the gas-cooled graphite-moderated system, exemplified in Calder Hall, which can generate electricity at much lower cost than the pressurised water reactor. Here zirconium is not suitable for fuel sheathing but is becoming popular for fuel element support brackets. For the support brackets in the Berkeley power station (designed and constructed by the A.E.I.–John Thompson Nuclear Energy Co. Ltd.) Metals Division is supplying special zirconium alloys which are resistant to corrosion by carbon dioxide, and have high strength at operating temperatures up to 500° C. If zirconium alloys resistant to the gas coolant at still higher temperatures can be developed, these might be suitable for fuel sheathing in advanced gas-cooled reactors.

Other types of reactor which would require large amounts of zirconium are the homogeneous aqueous and the sodium-cooled graphite-moderated reactors, but further work on these is now under review, both in this country and in the U.S. Certain designs of heavy-water moderated gas-cooled reactor, now regarded in this country as a very promising advanced reactor system either for power generation or marine propulsion, may also require zirconium alloy components.

There are few uses for wrought zirconium outside the nuclear engineering field, since its most attractive physical property—good corrosion resistance—is in almost all instances matched by that of titanium, which is at present considerably cheaper than zirconium.

Men with Ideas—10

Norman Eadie

THE major raw material used in the making of polythene is ethylene gas, derived from the catalytic cracking of oil.

At Plastics Division's Polythene Works at Wilton the ethylene is brought to high pressure in several stages. The compressors used need repairing from time to time, and before work can begin gas must be released to bring pressure in the machines down to atmospheric pressure.

But ethylene gas is expensive—in fact it accounts for most of the cost of producing polythene—and nobody likes to see it wasted. The question was, how to avoid this waste.

The idea that Norman Eadie, a 26-year-old chargehand in the cutting and blending bay, submitted to the Suggestion Scheme Committee was simple, like most good ideas, but it did the job. The details are still secret, but it can be said that Norman Eadie's brainwave saves much of the valuable ethylene that used to be wasted when compressors were repaired.

Eadie used to be a clothing salesman in a Middlesbrough store but joined I.C.I. in 1953 because he could see no prospects of promotion. He won his promotion to chargehand in 1956 and now wins something else that is not likely to come the way of a clothing salesman: a Suggestion Scheme award of £500.

NEWS IN PICTURES

Visit to new carbide plant. *When Sir Alexander Fleck visited I.C.I. works in the Fleetwood area recently he made a very complete inspection of the new carbide, acetylene purification and acetylene generation plants at General Chemicals Division's Hillhouse Works. Above (left, in white coat) he is seen watching the tapping of the carbide furnace. Left: Our picture shows the new carbide plant*

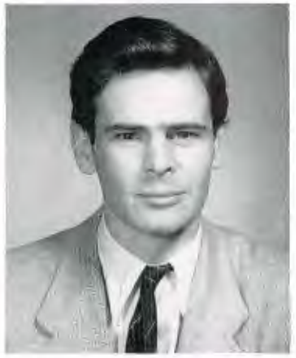
Royal visitor. *During Princess Margaret's recent visit to Belgium she toured the Brussels Exhibition. She is seen here on the I.C.I. stand with Mr. W. J. Marrable, who is showing her a 'Terylene' exhibit. Another royal visitor to the stand earlier in the month was Queen Elisabeth of the Belgians*

50 years' service. *Mr. Herbert Shaw of Castner-Kellner Works, General Chemicals Division, completed 50 years' service with the Company in September. He is seen here receiving the portable television set he chose for his award from Dr. R. N. Kerr*

60 years' service. *Mr. Jack Webb of Wallerscote Works, Alkali Division, received the congratulations of the Chairman on attaining 60 years' service. He joined the Company in 1898. In 1932, on the formation of the I.C.I. Alkali Football Club, he became a trainer, and was a member of the selection committee until this year*

Bronze medallist. *Miss Pauline Dargue, 17-year-old shorthand typist at Billingham Division, gained top marks out of thousands of girls throughout the country who took the Royal Society of Arts intermediate stage examination in typewriting. The Society awarded her a bronze medal. She was entered for the examination by the Division Secretarial School, where she received her training*

Mr. Arthur Lancaster *of Nobel Division recently saved the life of a small boy who had fallen into the River Irvine. He found the boy lying unconscious on the river bed. After artificial respiration had been applied, the boy was able to return home. It was not until Mr. Lancaster had to report a damaged wrist at Ardeer ambulance room that the story was revealed*



Mr. J. K. Bunnell *of Paints Division was a member of the English hockey team which toured South Africa recently. Out of 20 matches (including four internationals against South Africa and one against Kenya) they won 16 and were beaten only once*

Mr. D. Edwards *of Paints Division was selected to play for the England Amateur Association football team against Northern Ireland at Bournemouth on 27th September. He plays for Wycombe Wanderers and had the honour of being chosen for the England team without previous Football Association trials*

Maiden voyage. *Nobel Division's "Lady Roslin" crosses the Irvin bar on her first working trip carrying explosives to London. Paints Division's 'Linalux' marine paints have been used on all exterior su faces, Plastics Division's 'Darvic' and 'Vynide' from Leathercloth Division for some o the interior fittings*

Derek Ibbotson, *official world record holder, leads the field in the 1-mile event won by Peter Clark (6th from right) in 4 min. 1·7 sec. at the opening of the new Billingham Synthonia sports field*

"Red Rooster" *is the name given to this eight-wheel lorry which Wilton Works. Rumbling along at a steady 60 km., the giant Scan only a few minutes lat*

recently brought a 30-ton compressor unit from Basle, Switzerland, to mel cut the usual transport times from five weeks to one week and was on the scheduled time

'Hydex' *is a new PVC coated synthetic fabric made by Leathercloth Division. One use is for protective clothing as made by Jeltek Ltd., shown here being worn by a workman on the site of one of the new nuclear power stations*


1934


1941


1948

The Billingham Petrol Story


1935


1935


1944


1958

1934 *Preparatory work on the site where Billingham Oil Works now stands.*

1935 *The petrol plant, with the tank farm in the foreground. Inset: Mr. Ramsay MacDonald, the first Socialist Prime Minister (left), officially opened the plant in October* 1935. *Second from left is Lord McGowan and next to him Major Kenneth Gordon, one of the pioneers of the coal–oil process at Billingham.*

1941 *This picture, taken in August* 1941, *shows the ground crew refuelling and reloading a Spitfire V ready for the next patrol.*

1944 *The only photograph in existence of a Spitfire tipping over a flying bomb. I.C.I.'s 'Victane' gave the Spitfire the extra speed necessary to catch the buzz-bombs and to destroy them before they reached built-up areas.*

1948 *The Berlin airlift. Billingham switched back from motor fuel to aviation fuel for this emergency.*

1958 *To mark the end of petrol production some* 200 *men still with I.C.I. who worked in Oil Works in the early days were entertained at Billingham last month. Messrs. Ingle, Hill, Goodman, Wilson and Bennison with Mr. A. B. Goggs, deputy Oil Works manager.*

BUSHED

By Morley Shier

Illustrated by A. R. Whitear

It was Christmas Eve. The two prospectors had finished their supper, had washed up, and were sitting down to rest and read for the evening. They did neither. They sat and looked at each other. They had a problem.

Moss (for Mostyn) Thomas—I give you ten guesses on his nationality—and Eric Larsen—the same guesses—faced the morrow, Christmas Day, with no money to go to town; "no nothin' " to observe the holiday—the same food, the same cabin, the same company—themselves!

After a spell of silence Moss said "What do you think of the idea of hiking over the hill to Jim's for the day? We could bring that can of plum pudding we have been hoarding. We could bring the tail end of that bottle of rum, and . . . ah—we could bring ourselves. Jim's a trapper; he most likely has some game of some kind that he could make a Christmas dinner of."

Long silence.

"I like the idea," replied Eric. "Let's go and let's take the big can of corned beef, in case he should be short."

They turned in.

The following morning they trudged over the hill to Jim's. They took turns at breaking trail. The snow was deep, and they could use their snowshoes only part of the way.

On arrival they quietly approached the door of Jim's cabin, stuck their snowshoes up in the snow, wished Jim's big dog a merry Christmas, and were just about to knock on the door when they heard voices inside. They were disappointed to find that Jim already had company.

They were not eavesdropping, but they could not help hearing the conversation, which was in loud voices.

"Now look here, Jim, I don't want a lot of nails," they heard a strange voice say. "I only need a handful. It doesn't matter whether they are one and a half inch, two inch, or two and a half. Just a handful will see me out. I've got the lean-to just about completed. All I need is just a few nails—I thought I had plenty to see the job finished."

"No, Bob, I can't let you have them," they heard Jim's deep voice in reply. "Only last week you were over here for vinegar and the month before you were over for a bit of writing paper. I gave them to you. You knew how long you were going to be in here. You knew what supplies you needed. You're not a Chechaco. You are always running out and I can't let you have them. That's all there is to it."

"But Jim, I . . ."

"There's no use talking any more. I've got a few nails here, but I may be needing them before spring. You've got to learn what to do and bring in what you need when you come in in the fall."

A long, dead silence. Moss and Eric waited.

Then Moss knocked on the door—a hearty knock. Jim's voice bellowed "Come on in!"

They went in, and Jim was all alone. Moss and Eric exchanged glances as they realised that Jim had been having a hearty and heated conversation all by himself.

Jim's greeting was most friendly, and he was glad to have their company. "Where you birds been hidin'? Haven't seen you for a month of Sundays—thought you must have crawled in the hole in the ground and hibernated since last summer."

"No, we've been plugging away at the tunnel. Not ready for a smelter yet, but we still think we've got the makin's of a mine."

"Well, good luck to you both," said Jim, "and I hope you make her rich!"

They spent a good day talking trapping and mining

They heard a strange voice say "Now look here, Jim . . . I only need a handful"

and what they might be doing if they were outside. They talked of where they had been and what they had done on previous Christmas Days.

Jim had a haunch of venison already cooking, and with what they had brought along—the corned beef, the rum and the plum pudding—they fared well.

Along about four in the afternoon it was getting dark, so they thanked their host for a grand day and wished each other well for the New Year. Many promises were made to see each other again before the next Christmas.

With their snowshoes on and well muffled up, as it was turning cold, Moss and Eric started out for home, Moss leading and Eric following in the trail they had broken in the morning.

Finally, the second man, Eric, stopped in his tracks. The leader continued on for a way, then realised his partner was not following, so turned about and looking back asked "What's the matter?"

"Nothing's the matter, but I've been thinking that old Jim could have let him have the handful of nails!"

Calcutta—Shave or Shoeshine

Photo by Subodh Kumar Mitra (I.C.I. India)